

STUDIES IN THE AUSTRALIAN ACACIAS. V.

THE PROBLEMS OF THE STATUS AND DISTRIBUTION OF ACACIA BAILEYANA F.V.M.

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in Botany.

(From the Botanical Laboratories, University of Sydney.)

(Plate xviii; three Text-figures.)

(With a NOTE ON THE OCCURRENCE OF HYBRID ACACIAS, by E. CHEEL, Botanist and
Curator of the National Herbarium, N.S.W.)

[Read 27th November, 1935.]

Introduction.

The "Cootamundra Wattle" (*Acacia Baileyana* F.v.M.) has always created interest on account of the smallness of the area from which its natural occurrence has been reported. Because it grows and propagates well in cultivation, and has been successfully distributed in this and other continents for ornamental use, the problem arises, why its natural distribution is so restricted. A search shows that there are no really precise records of its natural occurrence, and that there were no specimens from a natural habitat in the National Herbarium, Sydney. In the hope that a quick result would be obtained, two excursions were made to the district concerned (in the south-east quarter of New South Wales) to study the distribution of the species and its relation to the habitat. Precise records of its occurrence for certain localities are set forth in this paper for the first time. The problems raised by the restricted nature of its distribution have been found to be so complex that they can only be stated, at present, without attempting to offer a final solution.

Three facts have caused doubt of the status of the species and have called forth the suggestion that it is a hybrid which arose in cultivation and then escaped. These facts are: (1). The first specimens received for description were from a tree in cultivation at Brisbane, Queensland (Mueller, 1888*a*, 169); (2). It is not unusual for seedlings from trees in cultivation to show some marked variations from the normal;* (3). There were no clearly marked early specimens from the natural habitat.

These problems of the distribution and status (including mode of origin) of the species are closely linked. Their solution would be an important contribution to our knowledge of what constitutes a species and of the factors

* In no case, however, have such seedlings been derived from seed set under conditions that excluded foreign pollen. Therefore it is possible that they are the F_1 generation of crosses between *Baileyana* and some other species of *Acacia*. Mr. E. Cheel, Botanist and Curator of the National Herbarium, N.S.W., has kindly added a note on "The Occurrence of Hybrid Acacias". From this note it will be seen how easily *A. Baileyana* appears to hybridize.

determining the establishment and limitation of species. From the investigations so far made about this species, it appears that a long and wide inquiry would be needed before finality could be reached. The spread of settlement in the country has made these inquiries difficult, and is rapidly making them more difficult. For this reason, and to provide a basis for further work, this paper will present the available knowledge germane to these problems of *Acacia Baileyana*, a clear statement of the problems and an indication of the lines along which they may be solved.

PREVIOUS RECORDS.

The Original Description.

In his paper, von Mueller (1888a) gives a very detailed and accurate description (in English) separating the new species from *A. polybotrya*. The description is apparently based on three lots of material received in Melbourne. By the courtesy of the Government Botanist of Victoria and the Government Botanist of New South Wales, I was able to inspect seven specimens of *Acacia Baileyana* sent on loan from the National Herbarium, Melbourne, to the National Herbarium, Sydney. These and three others are all the specimens of this species in the National Herbarium, Melbourne. Presumably, they would include the type specimens, as von Mueller was the Government Botanist of Victoria. In comparing the statements in the paper with the labels on the specimens, difficulty arises, as there are no reference numbers in the paper or on the specimens. All the sheets examined, except one, have the label of the "Phytologic Museum of Melbourne", which bears at the foot, "Baron Ferd. von Mueller, P.H. & M.D."

Of the first lot of material von Mueller says: "The species is named in honour of Mr. F. M. Bailey, from whom flowering branchlets were received, taken at Brisbane from a tree in Bowen's Park, the origin of which could not with certainty be traced." Of the two specimens from Bailey, the label of the first, in von Mueller's handwriting, is: "Acacia Baileyana, F.v.M. Cultiv. in Bowen's Park. F. M. Bailey." There is no date, and the specimen is a flowering one. The label of the second specimen, in von Mueller's handwriting, is: "Acacia Baileyana F.v.M. Cultiv. in Bowen's Park, Brisbane. F. M. Bailey." There is no date, and the specimen is a very poor and broken one with some loose pieces of leaf and inflorescence preserved in an attached folder. Accompanying the specimen is a note in red pencil in Bailey's handwriting on a sheet of rough paper, as follows: "This is a form (?) of *A. polybotrya* which came up amongst seeds collected by me many years ago on or near Seaview Range back 60 miles from Cardwell the tree never seeded at Bowen Park and is since dead. F.M.B." Cardwell is a small town near Townsville, Queensland. Mr. C. T. White, Government Botanist of Queensland, in a letter dated 29th July, 1935, informs me that the seeds referred to were "mostly without names, and were supposed [italics mine] to have come from the neighbourhood of Cardwell"; and that "evidently a mistake had been made as the species [i.e., *A. Baileyana*] was quite unsuitable for growing in the tropics", and there is no such specimen from North Queensland. Cardwell, therefore, does not concern us.

Of the second lot of material von Mueller says: "Somewhat later, fruiting specimens were sent by the Rev. Dr. Woolls, who got them from Mr. H. D. Coker of Brookfield, through Mr. John Dawson of Humberstone; he found this rare species only near Cootamundra on one of the sources of the Murrumbidgee and near To-morrow on a Tributary of the Lachlan River on stony ridges up to an elevation of about 1,600 feet." "To-morrow" is doubtless Temora. *The Sydney*

Mail (1888) gives "Humberstone" as the name of Mr. Dawson's property in a suburb of Sydney. An old resident of the locality tells me that the property was at the corner of Parramatta Road and Lang Street, in what is now North Croydon. There are three specimens in the Herbarium that are possibly referred to in the above quotation. The first is a small specimen in bud, labelled: "Acacia Baileyi, F.v.M. Murrumbidgee. Mr. Coker. Dec., 1887." The second is a fruiting specimen and there is no official label; but a small slip of paper has at the top, in Dr. Woolls's handwriting: "A. polybotrya.", and below, in von Mueller's handwriting: "Dec. 1887. Revd. Dr. Woolls. Acacia Baileyana F.v.M." The third specimen is "Seed from J. Dawson per Rev. W. Woolls—1887" (letter from the Government Botanist of Victoria, 3rd July, 1935). These specimens are not easily correlated with von Mueller's statement; but they are not inconsistent with it, for in December the trees would show both ripe fruits and young buds.

Of the third lot of material, von Mueller says: "Quite recently *A. Baileyana* has been found also near Wagga Wagga by Messrs. Garland and Deane." There is one specimen in the Herbarium referable to this statement, labelled: "Acacia Baileyi, F.v.M. Bet. Murrumbidgee and Lachlan R. J. R. Garland. 1887." It is a very small broken specimen of foliage only.

The only other important specimen in the Herbarium is an unnamed, broken flowering one labelled: "Near the Parramatta River. Dr. Woolls. 1887."

The other specimens in the Herbarium are four from cultivation: at Sydney, N.S.W., and East Kew, Vic. (1899), and Oakleigh, Vic.—two—(1891).

Von Mueller's paper, read on 12th December, 1887, was based partly on material derived from seed of doubtful origin sown at Brisbane, Queensland, about 500 miles from the supposed natural home. About that time he had a specimen from near the Parramatta River,* N.S.W., 260 miles from the supposed natural home; and four years later the species was cultivated some 300 miles in the opposite direction from the supposed natural home. Until June of the present year, the only specimens of the species in the National Herbarium, Sydney, were from cultivation. These facts have caused doubt of the species being a naturally occurring one. This question will be discussed after reference to later records and the statement of my own observations.

Later Records

There are three contemporary records which regard the species as occurring naturally in the Cootamundra District. Woolls (1888) says, "This is a species from the Murrumbidgee, which has hitherto gone under the name of *A. Polybotrya*. . . . Mr. Dawson, of Humberstone, has cultivated this shrub with much success." In the *Sydney Mail* (1888) it is recorded that the species was called the "Cootamundra Wattle" from the fact that "Mr. Dawson, of Humberstone, Burwood, distributed very liberally seeds of this beautiful species, which had been procured for him in the neighbourhood of Cootamundra". It is also stated that the figure in von Mueller's "Iconography" (Mueller, 1888b) was drawn from specimens from Mr. Dawson's garden. Maiden (1911, p. 9), after quoting extensively from von Mueller's paper, quotes a newspaper article written by himself "shortly" after it, in which he says that Mr. John Dawson

* Mr. Dawson's property was only about 300 yards from some mud-flats of the Parramatta River.

"brought seeds from Cootamundra and distributed them among his friends", and that *Acacia Baileyana* is "naturally found only . . . about Cootamundra, Bethungra, Big Mimosa Run, in the Wagga District and thereabout".

Later records of localities are, in general, repetitions of those given in von Mueller's paper, with variations. Such are Moore and Betche (1893, p. 171), Maiden (1906, p. 66. and 1911, pp. 9-10) and Anderson (1932, p. 37). The localities are: Cootamundra, Bethungra, Temora, Barmedman, Wagga District, "Big Mimosa Run, Wagga District", and "Parish of Inglebah, County Bourke (Temora)". Judging from the history of the locality recorded by Cramp (1923, p. 342), "Big Mimosa Run, Wagga district" would be in the angle (and its extension westward) between Pucawan, Temora and Mimosa (see Text-fig. 1), and would include the Parish of Inglebah (Ingalba). Today, it would not be described as "Wagga district". I can find no signs or report of the species occurring naturally at present in what would commonly be understood as "Wagga district".

Summerhayes (1933) lists many references to the species in botanical and horticultural literature. Those available to me do not add to our knowledge of the species, but some of them contain errors whose origin will be apparent on reading the present paper. The species is not about Wagga Wagga, and neither Wagga Wagga nor Cootamundra is at a source of the Murrumbidgee (Summerhayes, 1933); and it is not native of Queensland (Luxford—and the Editors—, 1916, and Comber, 1929).

There are two records of personal observation. Cambage (1902) made a journey through the district, and specifically mentioned the *Acacias* observed. Though passing through Barmedman and Temora, he only notes *Acacia Baileyana* between Stockinbingal and Cootamundra and on the main Temora-Cootamundra road a few miles to the west (p. 198), also between Cootamundra and Juneec (observed from the train, p. 202). From the inquiries, he concluded that a circle of radius about 30 miles centred between Cootamundra and Temora "would have included every tree of Cootamundra Wattle in the known world" before its cultivation (p. 198).

Bishop Dwyer (1921, p. 218) records *A. Baileyana* near Temora on "Ironbark Ridges". He describes these ridges as frequently having "ironstone and quartzite pebbles" mixed in the clayey or shaley soils, with the red Ironbark tree (*Eucalyptus sideroxyton*) "usually very predominant" (p. 212).

Absence of specimens in the National Herbarium at Sydney or at the School of Botany, University of Sydney, makes verification of the records difficult.* Both Cambage and Dwyer, who record visits to the locality, do not mention Barmedman as a location for the species. And I regard references to the "Wagga district" as referring to localities which to-day would not be so described.

Summary of the Previous Records.

We expect, therefore, to find *Acacia Baileyana* in the neighbourhood of Cootamundra (particularly north-west), Bethungra and Temora (particularly south-west) and possibly Barmedman, growing on stony (ironstone and quartzite) ridges associated with the red Ironbark (*Eucalyptus sideroxyton*). In a previous

* The Keeper of Botany, British Museum (Natural History) and the Deputy Keeper of the Herbarium, Royal Botanic Gardens, Kew, inform me by letters (dated 19th and 17th July, 1935) that there are no wild specimens represented in the Herbaria at South Kensington and Kew respectively.

paper (Newman, 1933, pp. 147-148), I showed that these localities lie in an area of coincidence of Silurian sedimentary rocks (associated with patches of granites and porphyries), an altitude of between 500 and 1,500 ft., and an average annual rainfall of between about 18 and 23 inches. The only other such coincidence in New South Wales is a much smaller area just to the north.

RECENT OBSERVATIONS.

Locations.

During October, 1934, and May, 1935, I made a search, the extent of which is shown in Text-figure 1. No sign of the species growing naturally was seen in the possible parts of the routes outside the area shown in the map, i.e., from Bathurst through Blayney to Cowra, and through Tuena to Crookwell and Goulburn; from Goulburn through Gunning to Rugby (by back roads) and Boorowa; and from Bookham to Gunning. No sign of it was observed on the route from Cowra through Marsden, Corringale and Barmedman to Temora, nor from Boorowa through Murringo and Monteagle to the Bribaree Hills and back into Wallendbeen. Residents in the localities said the species does not grow naturally in the Murringo district nor along a cross-country route travelled weekly between Thuddungra and Temora. I could not confirm a report of it for two miles south of the road on Black Range between Boorowa and Murringo. In the south of the area, the species could not be located by observation or inquiry south of a line joining Mimosa and Mitta Mitta and east of a line joining Wallendbeen and Adelong Crossing. In the central part of the area, the species was found in various situations among the localities marked A, B, C, D, E, and HJK, on Text-figure 1.

The area within which *Acacia Baileyana* was found, enclosed in a rectangle in Text-figure 1, is shown in greater detail in Text-figure 2. In the short accounts of each locality, the numbers refer to the specimen numbers in my *Acacia* Herbarium. Duplicates of Nos. 301, 304, 305, 306 and 321 are in the National Herbarium, Sydney, and the Herbarium of the School of Botany, University of Sydney.

Locality A.—The species was seen for about two and one-half miles of route, in very hilly country on the eastern side of the divide, rising from a little over 400 metres to nearly 600 metres. The trees were mostly in the depressions, and extended into the cleared land. Specimen No. 305 was taken at the northern end of this locality from the "Fairfield" Station of Mr. Lindsay Thompson. Specimen No. 306 was taken from the tree shown at the left of Plate xviii, fig. 1, on the property of Mr. Bush, at the southern end of the locality. According to Mr. Bush, these magnificent trees extend for only about a quarter of a mile down the creek, whose course is not steep. The bed rock is porphyroid. These trees are growing in virgin timber, about 50 yards from the edge of the clearing in which were many seedlings, saplings and dead trees.

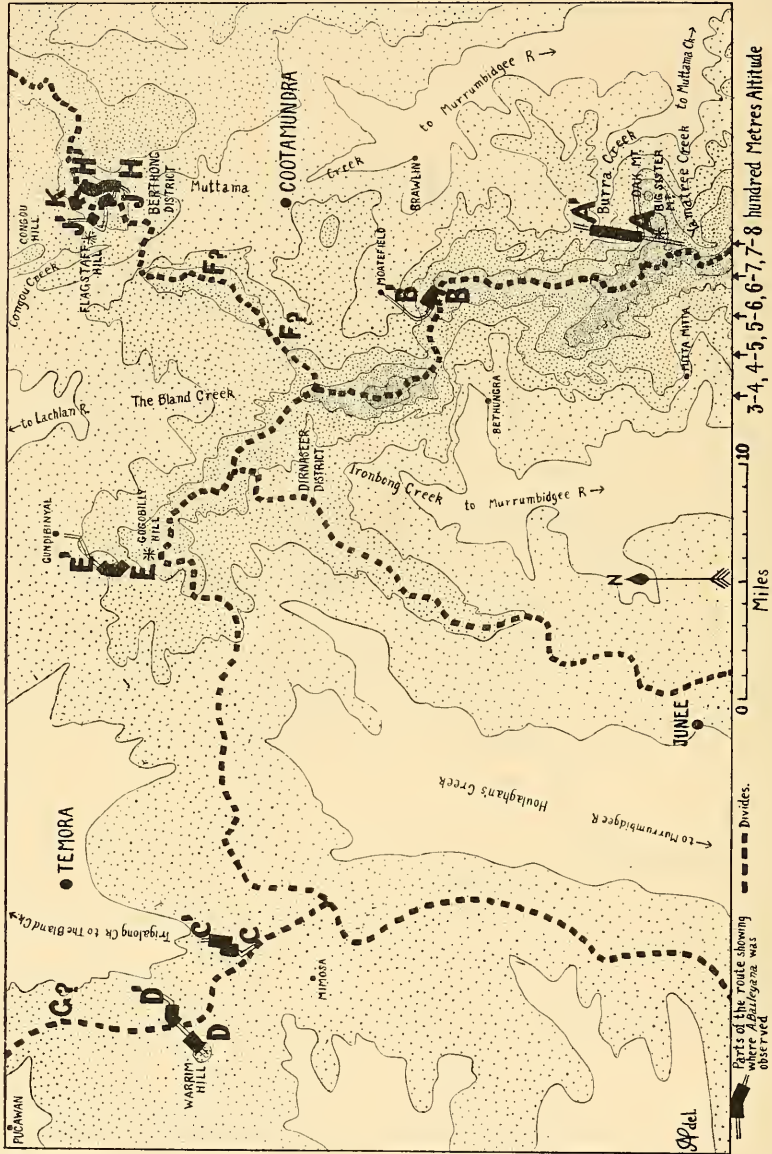
Locality B.—This is shown in Plate xviii, figs. 3 and 4, and is on the property of Mr. Cecil Ward of Moatefield. The altitude is about 600 metres and the bed rock is granitic. This place is a shallow valley running northerly from the divide to the top of the steep descent to the lowlands. In the partly cleared area shown in Plate xviii, fig. 4, there were a very few small seedlings of the species that had been nibbled by stock, and many trees of which all were dead. None of these trees showed signs of having been cut or ring-barked. Figure 3 on the same plate shows what must have been an exceedingly fine tree, surrounded by

about eight younger ones, all dead. Though the dead trees were plentiful in the partly cleared land, no trees, alive or dead, could be seen in the uncleared land behind.



Text-figure 1.—Map to show the route of the search for the natural habitat of *Acacia Baileyana*. The large capitals indicate the localities where it was found and reported (?). Compiled from the N.S.W. Department of Lands' Tourist Maps Nos. 28-174 and 32-155.

In the forest there were great quantities of loose and out-cropping rock, but in the cleared area the soil appeared deep and with hardly any stones. Mr.



Text-figure 2.—Map of the Cootamundra-Temora district showing the localities where *Acacia Baileyana* was found in a natural habitat. The large capitals indicate the localities, the ' being inserted to enable correlation with Text-fig. 3. Altitude zones are shown by stippling. The ? indicates an unconfirmed (for the present time) report of its occurrence. Compiled from the Tourist map of the N.S.W. Department of Lands, No. 28-174, and the "International Map of the World", 1:1,000,000 (Canberra).

Ward said the species grows in such situations for at least two miles south along the range.

Locality C.—The species was seen for nearly two miles as the route ran gently down from the divide, passing through the 350 metres altitude level. Some was in uncleared land. Specimen No. 304 was taken from a large tree, 30 feet high, one of a number left in a belt of trees between the road and the fields, near the junction of the Silurian and Cainozoic sedimentary rocks.

Locality D.—The species was seen for two stretches of about 0.6 and 0.4 miles of route just to the north-east of the crests of Warrim Hill and the divide, at and below 400 metres altitude. The soil was Silurian slate accompanied by quartzite gravel. The red Ironbark tree (*Eucalyptus sideroxylon*) was plentiful. Specimen 301 was taken from the tree shown well to the front in the left half of Plate xviii, fig. 2 (on Warrim Hill). On the Pucawan-Coolamon road, about three or four miles north-west from this place, a resident said that the district was "the home of these wattles", for they are always coming up in the fields after ploughing, and profusely in the forests after the big timber is cut down. There were numerous trees of the species growing along that part of the road, which ran north-south between the divide and a low ridge to the west.

Locality E.—The species was seen for about three-quarters of a mile of route at about 400 metres altitude along the western side of a shallow valley running northerly. On the property of Mr. Sleeman, at the southern end of the locality, there were a number of trees growing in the cleared valley, which Mr. Sleeman said were not escapes from cultivation. He also said that the species grows in similar depressions for several miles in either direction along the range. According to Pittman (1914), this locality is on Silurian sedimentary rocks.

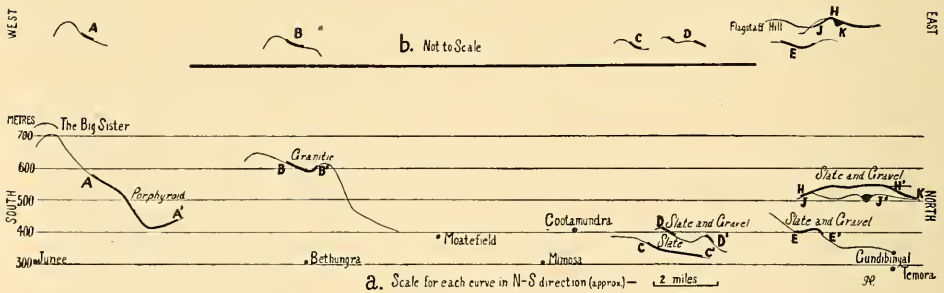
Locality HJK.—This is the locality where the species appeared to be most plentiful. Parts of it are known as "Wattle Valley" to the people of Cootamundra, who use it as one of the sights to show visitors in the season. The profusion of trees here is probably due to the area being in a proclaimed reserve for some years past. It is in the district of Berthong and is from 500 to 550 metres in altitude, the geological formation being Silurian slate with quartzite gravel. The red Ironbark trees are plentiful. The species was seen along the route HH', a distance of nearly three miles, either in a south facing shallow valley or on the eastern slopes of the divide. At J, in a shallow valley facing south-east, ten specimens, No. 207, were taken from the trees shown in Plate xviii, fig. 5 (looking west). At J', several steep-sided, shallow, gently sloping gullies facing west were full of the species. Plate xviii, figs. 6 and 7 are from photographs taken in one of these gullies. Figure 6 shows the trees in profusion among the Ironbarks. Figure 7 shows a fallen one of the many dead trees among the living ones, without sign of having been cut or ring-barked. These gullies, though facing west, are sheltered by Flagstaff Hill, and have protection by the good stand of big timber. Specimen No. 321 was taken from this situation. At K, which was not visited, the field-glasses showed a splendid growth of the trees.

Reports were received of the existence, a few years ago, of the species near the Cootamundra-Temora and Cootamundra-Dirnaseer roads on or about the divide west of Cootamundra. An examination failed to reveal any at this time. A report I could not confirm was for the divide west of Temora where the Temora-Pucawan road crosses it. These localities are marked F? and G?, respectively, in the maps (Text-figs. 1 and 2).

Of the localities recorded here (see Text-fig. 2), J and HH' or F? would probably correspond with von Mueller's (1888*a*, p. 170) "near Cootamundra on one of the sources of the Murrumbidgee" (J' and K are on a tributary of the Lachlan); CC' and DD' would probably correspond with his "near To-morrow on a tributary of the Lachlan River" and also with Maiden's (1906, p. 66) "Found also on Big Mimosa run, Wagga district, also Parish of Inglebah"; I was directed to CC' by Bishop Dwyer (cf. Dwyer, 1921, p. 218); F? would correspond with Cambage's (1902, p. 198) "parts of the main coach road from Cootamundra to Temora". The localities AA', BB' and EE' are probably additional to the previous records. It is interesting to note that, apart from the large towns and the more settled area between Sydney, Bathurst and Goulburn, it is only within 20 or 30 miles of the line joining Cootamundra and Temora that the species is found frequently in cultivation or with signs of former habitation; as though, being common in the area, it was cleared out except around the dwelling when settlement took place.

Habitat Factors.

Physiographical.—Text-figure 3 (with which cf. Text-fig. 2) contains two diagrams to show the relative altitudes and aspects of the localities where the species was found. It will have been noticed already that the localities are all in proximity to some part of the system of more or less pronounced ranges which are a feature of the district. Text-figure 3 will emphasize the fact that these localities are not only near the crest of the divide, or (in the case of AA') of a prominent spur of it, but are in general in an aspect sheltered from the west and south by the high ground of the range. In some of the localities, AA', BB', EE', JJ', and K there is a tendency to keep to the depressions. These facts point to some factor tending to restrict the occurrence of the species to certain physiographic conditions, for the specifying of which there is not yet enough evidence. If the species were escaped from cultivation, I would not expect to find this local restriction of occurrence.



Text-figure 3.—Diagram to show the relative altitudes of the localities of *Acacia Baileyana* and nearby towns, etc. This should be studied in close comparison with Text-fig. 2.

a. Looking west.—Only the parts of the route immediately adjacent to the localities are shown. The north-south spacing of the localities, etc., is approximate only. The curves are rough projections on the north-south line of the parts of routes along which the species was observed, the heavy lines showing the actual part where it was seen.

b. Looking north.—Diagram not to scale, complementary to a, to complete the demonstration of the aspects of the various localities. The curves are not, of course, in the correct east-west sequence.

Another interesting feature is that the species occurs towards the high ground of the regions concerned. This is not mere repetition, but emphasizes the fact that at the eastern side of the area shown in Text-figure 2 there is plenty of country at the same altitude as localities CC' and DD', and possessing similar aspects; and that, in spite of this, the species was not observed by me or reported to me in situations other than those already described. The species may therefore be tending to keep to the high ground, subject to certain conditions of aspect, etc., the high ground in the west being of a lower altitude than the high ground in the east. The two localities of greatest altitude are on igneous rocks, namely, AA' and BB'. If the sedimentary rocks have been denuded from these localities it is possible that the species is fighting a rearguard action in the silty depressions containing conditions as nearly similar as possible to those of the sedimentary formation before the physiographic changes took place. It seems possible, therefore, that *Acacia Baileyana* is a relict of a species which may have flourished widely before physiographic changes initiated a losing battle between it and the environment. The possibility of it being a relict species was suggested by Cambage (1902, p. 198). The existence of such relicts following on physiographic or climatic change is not unknown elsewhere, as, for example, the basalt flora of Mt. Wilson (Brough, McLuckie and Petrie, 1924), and plants referred to in a recent discussion on the origin of the British Flora (Royal Society, 1935, p. 570).

Edaphic.—The study of the soil conditions associated with a species in the field would be very lengthy, if done in detail. A few rough observations were made in case they should indicate some factor operating. As the samples were taken at a depth of about three inches, they would provide information only concerning conditions governing the establishment of seedlings. Ten samples were taken from among the different situations (except EE', HH' and K). The range of pH was from 5.4 to 5.7, except for the porphyroid locality AA' (6.6 and 5.8). This range is in general more acid than for the soils of four other localities in or towards the region concerned. The water capacity of the soil as it occurred without sorting, showed no extremes in the measurements made on the samples from where the species occurred; but the other four samples gave extremes in one or other of the measurements made. There is the suggestion of the restriction of the species to a band of soil conditions governing seedling growth, the determination of which would entail extensive soil analyses.

Biotic.—The continuation of the species in its natural home, if this region is its natural home, is in danger from the biotic factors of its environment. Sheep and cattle (and probably rabbits) eat the seedlings, and property owners seem to have an objection to it, for so many spoke of cutting it out. In addition, the trees seem to be short lived, due either to a normally short life-period or to some natural enemy such as borer. These factors, combined with bush-fires and fluctuations in stocking, would provide ample explanation of its disappearance and reappearance from time to time in various situations.

In considering the influence of the rest of the vegetation on the local distribution of the species, it must be remembered that the present day forests of that region are not necessarily of the same composition or profile as the forests were before settlement occurred. For instance, in the area westerly from Temora, much of the uncleared land to-day is covered with forests of red Ironbarks (*Eucalyptus sideroxylon*) and "pines" (*Callitris* spp.), etc., so dense that long vistas cannot be obtained. Plate xviii, fig. 2 shows a not very dense forest of

that area. According to Cramp (1923, pp. 345-6), this forest covered much of the country when the late Mr. William Fisher "selected" at Mimosa West in 1883. Steele (1931, p. 3) records that Mimosa run (later divided into Mimosa East and Mimosa West) was originally leased to McCansh and Windeyer in 1857. Gow (1925, pp. 5-6) says that before the coming of settlement to the district near Ardlethan (bordering the map in Text-fig. 2 on the west) there was a tall forest of Eucalyptus and "pines" in which long views could be obtained; and that with the clearing of the tall forest a dense growth of seedlings took place. It is probable that the specimens sent to von Mueller from this district were from regeneration forests. In support of this is his statement that the height of the species is not more than 15 feet, whereas many trees up to 30 feet high can be seen.

Variations.

Doubt of the specific status of the species has been due not only to absence of clearly located specimens from the reputed natural home, but also to the experience of apparent variability of some of the characters. Seedlings markedly different in leaf-form and colour from the more typical *Baileyana* seedlings frequently appear in cultivation. The impossibility of the hybrid origin of these marked variations has not yet been demonstrated. Illustrating less marked variations, Cheel has exhibited (1930, p. xv) leaves from 24 trees of *Acacia Baileyana* which show a variation in the number of pairs of pinnae, and in the presence or absence of hairs on the young branches. By the courtesy of Mr. Cheel, I was able to make a slight statistical examination of the numbers of pairs of pinnae in some of the trees he mentioned, growing on his property at Hill Top.

Two series of samples were taken from each tree: Series A, from the end of a branch to one foot or the first junction, if near one foot; Series B, from the first junction to the second junction or for one foot. The samples were taken low, shoulder level and high. The scores from the three samples were added together and are shown in the following table:

Tree Number.	Number of leaves in Samples A having						Number of leaves in Samples B having					
	2	3	4	5	6	6+	2	3	4	5	6	6+
	pairs of pinnae.						pairs of pinnae.					
22		6	60					7	33	1		
23	2	13	25	12			6	29	17			
24	5	27	42				4	40	19			
25		8	36	24				29	56			
27	1	55	32	2			4	50	21	1		
28			17	11	22	6			5	24	10	4

On trees Nos. 23, 24 and 28, in passing from the end of the branch, the maximum score changes to a smaller number of pairs of pinnae. On trees Nos. 22, 25 and 27, where the maximum remains on the same number of pairs of pinnae, the score for the smaller number of pairs becomes proportionately greater on passing down the branch. These figures suggest that variations in the number of pairs of pinnae may be due not to genetical factors so much as to variations in vigour at different periods of growth.

In the places where the species was found growing in what I interpret as the natural habitat, except for being with or without hairs on the young branches and varying in the number of pairs of pinnae within the above limits, the species presented a reasonably uniform appearance. There was never a suggestion of a hybrid swarm with or without close association of two possible parent species.

DISCUSSION.

The first problem that presents itself is whether what is known as *Acacia Baileyana* is a naturally occurring species, or whether it arose suddenly in cultivation, as either a hybrid or a mutant, and then escaped from cultivation. The second alternative raises the problem of why the escape from cultivation in the early days should have taken place with vigour in one small district only, and in the parts of that district remote from the denser settlement, and why it should have retreated to a relatively specialized habitat.

The argument for the origin in cultivation is largely based on the presence of specimens from cultivation at Brisbane in the material on which the original description was based. But by 1880 there was a tree of the "Cootamundra Wattle" in cultivation in the garden of Mr. Joseph Hadfield, "Stanmore", Stanmore Road, Christchurch, New Zealand. Maiden, in the newspaper article contemporary with von Mueller's paper, said (Maiden, 1911, p. 9): "it has been largely cultivated (chiefly in Burwood gardens) for years". If the species could be in cultivation in New Zealand by 1880, there is no reason why it should not have been taken to Brisbane by "many years ago" before 1887. The dates of the first settlement of the Cootamundra and Temora districts and the country to the south of them give ample time for these wide dispersals in cultivation. There was settlement at Wagga Wagga in 1832 (Gormly, 1909, p. 7), Cootamundra in 1843 (Gormly, ?, pp. 147-8), "Warri" run, near Ardlethan in 1849 or 1850 (Gow, 1925, p. 8), Junee about 1845 (Gormly, 1915, p. 77), "Temora" run in 1851 (Steele, 1931, p. 3), and "Mimosa" run (west of Temora) in 1857 (loc. cit.). Settlement had so increased that Post Offices were established at Albury and Gundagai in 1843 and Wagga Wagga and Tumut in 1849 (Dalgarno, 1908, pp. 158-9). In view of the evidence of very early settlement and communication, it is quite probable that such a striking tree as the "Cootamundra Wattle" should be spread rapidly as an ornamental tree; so that the great distances of its reported early cultivation from the reputed natural home are no real bar to it being a naturally occurring species.

The question of the natural or cultivated origin of the species could be answered with a full knowledge of its earliest distribution in nature and cultivation. It may be noted, however, that three records (quoted above) published in Sydney soon after the description of the species, regard it as being brought into cultivation from its natural habitat in the region concerned. In any case there would still be the problems of the mode of origin of the species and the reasons for its present restricted distribution in the field. If it arose in cultivation, it is either a hybrid or a mutant. If it be of natural origin, whatever be the mode of origin, it is either an old species living in a restricted habitat or it is a new species that did not spread far before the coming of settlement restricted its powers of spreading.

Whether the species arose in cultivation or in nature, the practical approach to the solution of the problems will be the same. The question of it being a hybrid would require analytical breeding and synthetical crossing experiments, supported

by cytological examination of the species and the possible parents. Cytological examination would also be necessary in the study of the possibility of the origin by mutation, and might be combined with experimental manipulation of possible originating species with a view to inducing similar mutations. Whether it be a relict species or a new species in nature, the geology and physiography of the district are fundamental for solving the problem of its origin, and, with the study of the edaphic, climatic and biotic factors are fundamental for solving the problem of its restricted distribution.

These complex problems require specialist knowledge and methods in several branches of study. With increasing settlement of the area concerned, investigation will be still more difficult than it is to-day. In view of these considerations, the foregoing account of past and present information on the subject, and the statement of the problems have been made to serve as a foundation on which any may build who becomes possessed of relevant information.

From the evidence before me, historical, ecological, etc., I believe *Acacia Baileyana* to be a species occurring naturally in a restricted habitat at localities within about twenty miles of Cootamundra and Temora. The chief contribution of this paper to the solution of the problems is the presentation of detailed records of the species in its natural habitat.

SUMMARY.

A record is required now of our present knowledge of, and a statement is needed of the associated problems of, the restricted distribution, specific status and mode of origin of *Acacia Baileyana*; for increasing settlement will make field investigations more and more difficult.

The probable type specimens in the National Herbarium, Melbourne, are correlated with von Mueller's paper describing the species, and are found to be unsatisfying as evidence for the natural occurrence of the species.

One set of later records seems merely to repeat the vague statements of locality given by von Mueller. Another set of records speaks more definitely (from personal observation) of two of the localities mentioned by von Mueller. Absence of Herbarium specimens makes verification difficult.

An account is given of a search, and its results, made by the writer in the region concerned. This account gives detailed references to the localities where the species appeared to be growing naturally, and refers to Herbarium specimens presented by him to the National Herbarium, Sydney, and the School of Botany, University of Sydney. A brief reference is made to certain kinds of environmental factor. A general similarity of aspect (sheltered from the south-west) and altitude relationship (towards the highest ground) is shown in the physiography. The species is possibly a relict. Estimation of pH and of water capacity suggest a band of edaphic conditions governing seedling establishment. Biotic factors are at present against the species; it appears short lived, and there may be considerable fluctuations in its occurrence. The vegetation's composition and profile have changed since the coming of settlement.

It is shown that some of the variations in number of pairs of pinnae observed in the species may be due to fluctuations of vigour. No field observations suggested hybridity.

The various alternatives to *Acacia Baileyana* being a naturally occurring species are put forward and their implications referred to. Historical search shows that there was ample time and opportunity for the species to have been taken

into cultivation and carried far afield before von Mueller described it in 1887. The mode of origin of the species and its features of restricted natural distribution are closely linked. The methods of attack upon these problems are indicated.

The evidence supports the validity of *Acacia Baileyana* as a species occurring naturally in a very restricted area.

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* These are in the Mitchell Library, Sydney; and I would express my thanks to the Public Librarian for permission to inspect them.

† In the table of contents of Part ii of Vol. 24, the title of Article xvii, which is this paper, is "Description of some Papuan Plants". The title given here is at the head of Article xvii, but appears nowhere in the table of contents.

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EXPLANATION OF PLATE XVIII.

Photographs illustrating the Habitat of *Acacia Baileyana* (cf. Text-fig. 2).

Fig. 1.—Locality A'. Trees in virgin forest, along the course of a slow creek, at the foot of the Big Sister Mt. Looking southerly.

Fig. 2.—On Warrim Hill, Locality D. In a regenerating forest of red Ironbark and "Pine" (*Callitris*). Note the white quartzite gravel. Looking northerly. The nearest tree is 25 yards from the camera.

Figs. 3, 4.—Near Moatefield, locality B, looking southerly. 3 shows a large dead tree of *Acacia Baileyana* which had split. The figure is standing on the fallen half. There are about eight younger dead trees encircling it, probably seedlings of it. 4 shows the locality as a shallow valley just below the top of the divide. The small dead bushy tree in the centre of the picture is an *Acacia Baileyana*. There are many dead trees of the species in the area, not showing in the picture (cf. Fig. 4).

Fig. 5.—Near Berthong, Locality J. The bushy trees in the middle distance are *Acacia Baileyana* in a shallow valley running south-east. Looking west. This land is partly cleared.

Figs. 6, 7.—Near Berthong, Locality J'. In a gully running west, showing *Acacia Baileyana* among red Ironbarks, in a regeneration forest. Note the fallen dead one at the left of Fig. 7. Looking south-easterly.

These photographs were taken in May, 1935, the trees being in bud. The whiteness of their appearance is due to the extremely glaucous foliage.